Q.1 Define Following.

1. Image

An image is a digital representation of visual data. It is typically composed of a grid of pixels, where each pixel contains information about the color and intensity of light at a specific location in the image.

In computer vision, the term "image" refers specifically to the digital data that represents visual information, and it serves as the primary input for algorithms and systems designed to interpret and make sense of visual data.

1. Quantization

Quantization is the process of mapping continuous infinite values to a smaller set of discrete finite values.

Quantization in computer vision refers to the process of reducing the number of distinct values (or levels) in an image or a dataset. It is commonly used to simplify and discretize data, making it more manageable and efficient for various computer vision tasks. Quantization is particularly important in digital image processing and computer vision because it can help reduce the computational complexity and memory requirements of algorithms while still preserving essential information.

1. Gray scale resolution

Grayscale resolution refers to the number of distinct shades of gray that can be represented in a grayscale image.

Common resolutions include 1-bit (black and white), 8-bit (256 shades of gray), and 16-bit (65,536 shades). The choice depends on the level of detail needed for a specific application.

3 Spatial Resolution

The term spatial resolution corresponds to the total number of pixels in the given image. If the number of pixels is more, then the resolution of the image is more.

Spatial resolution is typically expressed in terms of a unit of distance per pixel, such as meters per pixel or centimeters per pixel. Higher spatial resolution means smaller pixel sizes and the ability to capture finer details in an image. Lower spatial resolution results in larger pixel sizes and less ability to distinguish fine features.

1. Enhancement

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further [image analysis](https://www.mathworks.com/discovery/image-analysis.html). For example, you can remove noise, sharpen, or brighten an image, making it easier to [identify key features](https://www.mathworks.com/help/images/pixel-values-and-image-statistics.html).

1. EM Spectrum

*Electromagnetic waves (EM waves) are a fundamental concept in physics that describes the propagation of electromagnetic radiation through space. These waves are a combination of oscillating electric and magnetic fields that travel through a vacuum or a medium at the speed of light*

Q.2 what is image negation, logarithmic and gamma transformation

Image negation, logarithmic transformation, and gamma transformation are three different image processing techniques used to manipulate and enhance digital images. Each of these techniques serves a specific purpose and can be applied to adjust the appearance of images for various applications.

1. \*\*Image Negation\*\*:

- \*\*Definition\*\*: Image negation, also known as image inversion or image complementing, is a simple image processing operation that involves reversing the pixel values in an image.

- \*\*Process\*\*: In this operation, the brightest pixels become the darkest, and vice versa. This can be achieved by subtracting each pixel value from the maximum possible pixel value (usually 255 for 8-bit images). So, if a pixel originally had a value of 100, it would become 155 after negation.

- \*\*Use Cases\*\*: Image negation can be used for various purposes, such as creating artistic effects or enhancing specific features in an image.

2. \*\*Logarithmic Transformation\*\*:

- \*\*Definition\*\*: Logarithmic transformation is a technique used to enhance the visibility of details in the darker regions of an image. It compresses the dynamic range of pixel values, making darker areas more distinguishable.

- \*\*Process\*\*: Each pixel value in the image is replaced with its logarithm, which spreads out the values in the darker regions, making them more visible.

- \*\*Use Cases\*\*: Logarithmic transformation is often used in medical imaging to enhance the visibility of structures in X-ray or MRI images, as well as in astronomy to improve the quality of dimly lit astronomical images.

3. \*\*Gamma Transformation\*\*:

- \*\*Definition\*\*: Gamma transformation, also known as gamma correction, is used to adjust the brightness and contrast of an image. It controls the relationship between the pixel values in the input and output images.

- \*\*Process\*\*: The gamma transformation function applies a power-law curve to the pixel values. It involves raising each pixel value to a certain exponent (gamma value). This process can either increase or decrease the image contrast and brightness.

- \*\*Use Cases\*\*: Gamma correction is widely used in digital image processing to correct for the nonlinear behavior of displays and cameras. It can be used to improve the overall appearance of images when they appear too dark or too bright..

*Waves created by the interaction of vibrating electric and magnetic fields are known as electromagnetic waves. An oscillating electric and magnetic field makes up EM wav*